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(56) Documents cited
GB 2058375 A GB 2042748 A GB 0734177 A

(58) Field of search
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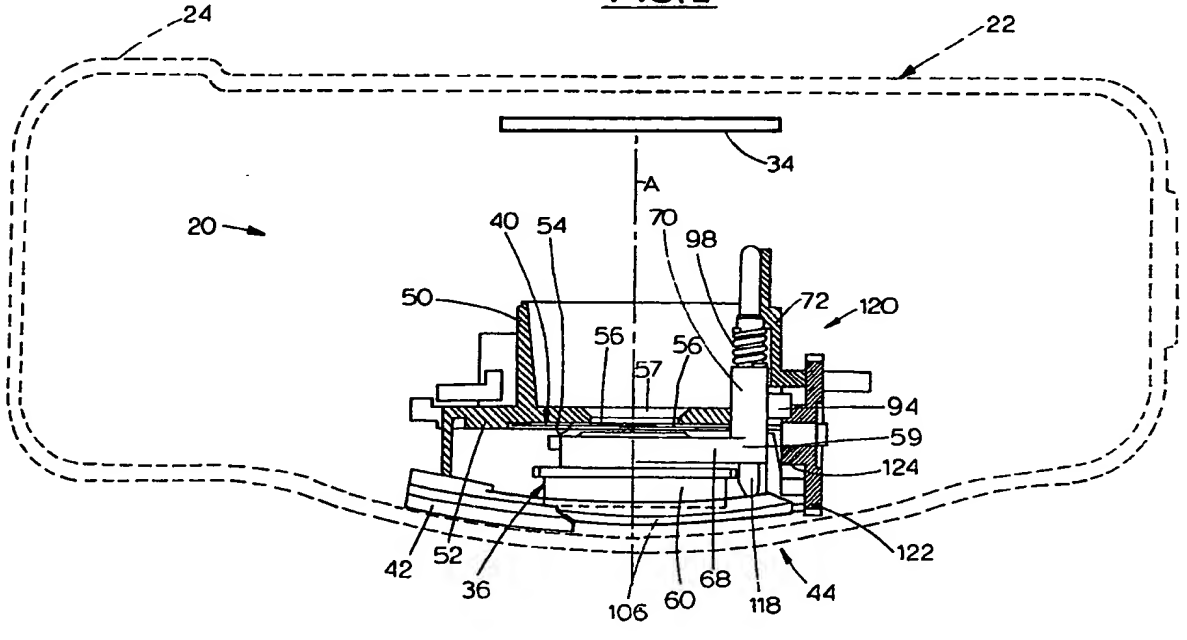
(54) Retractable camera lens assembly

(57) A retractable lens system (20) for a camera (22) includes a stop for determining at least one operating position for the camera lens assembly. A spring (98) constantly urges the lens assembly against the stop. When a lens cover (42) is moved from the open to the closed position, the lens assembly (36) is moved against the force of the spring to a compact retracted position close to the shutter assembly (40). In a camera with adjustable focus, the shutter assembly is fixed relative to the camera film plane and the lens assembly is moved through a range of focus positions by a solenoid and lever arrangement that adjusts the position of the stop. The pivot point of the focus lever can be calibrated by a detent system for a specific lens back focal length. The retracted position is outside the range of focus positions.

FIG. 2



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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 1990.

RETRACTABLE CAMERA LENS ASSEMBLY

Field of the Invention

This invention relates to improvements in retractable lens assemblies for cameras.

Description of the Prior Art

One common type of camera for exposing film with a light image of a subject includes a camera body or housing with structure defining a film plane where the film is located for exposure. A lens assembly including at least one optical lens element is located along an optical axis extending perpendicular to the film plane. To expose the film, a shutter normally mounted in a fixed position along the optical axis between the lens assembly and the film plane is opened for an interval of time. The lens assembly may be moved in the direction of the optical axis to focus the camera at different object distances. In order to protect the lens assembly when the camera is not in use, a lens door may be closed over the front of the lens assembly.

There has long been a need for a camera that is small in size, particularly when it is not in use, that can conveniently be carried and stored. A difficulty with meeting this goal has been the size of the camera along the

optical axis. Known lens assemblies have not been able to satisfy the need for an inexpensive camera having a compact size in the optical axis direction.

One approach that has been employed in the past has been to move the camera lens to its focus position closest to the film plane and then to move the lens door to a closed position as close as possible to the lens assembly. Factors including unavoidable production variation in lens assemblies require that significant space be present between the lens assembly and the shutter assembly even when the lens assembly is moved to the focus position closest to the film plane. Similarly, significant clearance must be maintained between the lens door and the front of the lens assembly. Because of the necessity for clearances in the axial direction, cameras employing this approach have been undesirably large in the axial direction.

In an attempt to obtain a more compact configuration, many cameras have used a movable shutter rather than a fixed shutter. In this type of camera, the lens assembly and the shutter are combined into a single subassembly moveable as a unit along the optical axis to different focus positions. When the camera is not in use, the subassembly including the lens assembly and shutter is retracted as close as possible to the film plane and then the lens door is closed for storage. This construction has been widely used because it permits a compact arrangement, but it has disadvantages of complexity and high cost that render it unacceptable for low cost cameras. The complexity and cost result from the necessity for a light tight enclosure around the optical axis between the film plane and the movable shutter, and the requirement for the shutter to be mechanically or electronically linked to other components of the camera such as a shutter release button and film winding mechanism.

A fixed shutter system is simpler and less expensive. There is no need to use a light tight enclosure in the

region between a fixed shutter and an axially movable lens. The required connections between the shutter and other camera components are easier to make with a fixed shutter. Thus, there has been a need for a rectractable lens system capable of achieving the advantages of minimal axial thickness for storage with a fixed rather than a movable shutter system.

In cameras having a fixed focus, the lens assembly has a single operating position. In this type of camera, it would also be an advantage to achieve a compact size for storage and transport and to protect the lens with a door or cover when the camera is not in use. Thus it would be desirable to be able to retract the lens from its operating position while maintaining accurate control of the position of the lens assembly.

In the past many cameras have used threaded lens assemblies in which the lens is moved axially by being rotated during assembly of the camera in order to compensate for production variations in the back focal length of individual lens assemblies. One difficulty in retracting such a lens assembly to achieve most compact storage is that the exact axial position of the lens elements will vary from camera to camera and therefore the amount of lens retraction that is possible and necessary for most compact storage cannot be predetermined. In past systems this has resulted in compromise lens retraction systems which can only partially minimize clearances in the retracted lens position.

Summary of the Invention

It is a principal object of this invention to provide a retractable camera lens system that reduces the size of a fixed shutter camera in the optical axis direction. Other objects are to provide a retractable lens system for a low cost camera; to provide a system using few parts that is simple, reliable and economical to make and assemble; to provide a lens retraction system that is integrated with the

focusing mechanism, but wherein the focusing mechanism does not prevent movement of the lens assembly to a storage position outside the range of focus positions; to provide a system in which the need is avoided for significant axial clearances at the front and back of the lens assembly when the camera is not in use; to provide a lens retraction system for either fixed or adjustable focus cameras in which the retracted and operating positions of the lens assembly are accurately determined to provide a retractable lens assembly incorporating the ability to calibrate the lens position along the optical axis to account for production variations such as back focal length; and to provide a retractable lens system overcoming disadvantages of systems used in the past and meeting the need for a compact yet inexpensive camera.

In brief, the above and other objects and advantages of the invention are achieved by providing a camera having a camera body and a film plane in the body. The camera includes a lens assembly with a lens. A shutter assembly is mounted in a fixed position transverse to the optical axis in the camera body between the film plane and the lens assembly. The lens assembly is mounted on the camera body for axial movement along the optical axis. The camera has a stop for defining at least one operating position of the lens assembly. A spring continuously applies a force to the lens assembly urging the lens assembly axially away from the shutter assembly and against the stop. To retract the lens assembly, the lens assembly is moved away from the stop and against the force of the spring to a retracted position adjacent the shutter assembly.

Brief Description of the Drawings

The invention and the above and other objects and advantages may best be understood from the following detailed description of the embodiment of the invention shown in the accompanying drawings, wherein:

FIG. 1 is a front elevational view of a retractable lens system in accordance with the present invention, with portions of a camera shown in broken lines;

FIG. 2 is a bottom plan view of the of the retractable lens system shown in section along the line 2-2 of FIG. 1 camera with the lens cover frame and focus lever omitted for clarity;

FIG. 3 is a view similar to part of FIG. 2 showing components of the retractable lens system in the open position;

FIG. 4 is a view like FIG. 3 showing components of the retractable lens system in the closed position;

FIG. 5 is a front elevational view of the retractable lens system similar to part of FIG. 1 with the lens cover and lens cover frame omitted for clarity;

FIG. 6 is a side elevational view of the retractable lens system taken from the line 6-6 of FIG. 1 and with an alternate focus lever calibration position shown in broken lines;

FIG. 7 is a side sectional view taken along the line 7-7 of FIG. 5 showing components of the retractable lens system in the closed position;

FIG. 8 is a view like FIG. 7 showing components of the retractable lens system in the close focus position; and

FIG. 9 is a view like FIG. 7 showing components of the retractable lens system in the far focus position.

Detailed Description of the Invention

Referring now to the drawings, there is illustrated a retractable lens system constructed in accordance with the principles of the present invention and designated as a whole by the reference character 20. The present invention is applicable to cameras of many types, and in the drawings by way of example there is shown a camera 22 in broken lines. Camera 22 includes a camera body or housing 24 with suitable apertures 26, 28, 30 and 32 for devices such as a flash, view finder, auto focus range finder and remote control signal detector. A film backing plate 34 fixed within the camera body 24 defines a film plane where film is positioned for exposure. An optical axis denoted by the line A in FIG. 2 extends perpendicular to the film plane.

In general, the retractable lens system 20 includes a lens assembly 36 that is movable toward and away from the film plane along the optical axis. Features of this invention can be applied to both fixed focus cameras and adjustable focus cameras. In the illustrated camera 22, a focus assembly 38 moves the lens assembly through a range of positions from a position farthest from the film plane (FIG. 8) in which a relatively distant subject is in focus and a position closest to the film plane (FIG.9) in which a relatively close subject is in focus. A shutter assembly 40 is fixed

with respect to the camera body. A lens cover 42 is movable between an open position (FIGS. 1, 3, 8 and 9) and a closed position (FIGS. 4 and 7). In the open position, the lens assembly 36 is uncovered and the camera may be operated. The closed position is intended for storage or transport of the camera 20 when it is desired that the lens assembly 36 be covered and protected. In accordance with the invention, when the lens cover 42 is moved to the closed position, the a lens retraction assembly 44 moves the lens assembly 36 to a retracted position outside of the range of focus positions and close to the shutter assembly 40 in order to reduce the thickness of the retractable lens system 20 and camera 22 in the direction of the optical axis A.

Proceeding now to a more detailed description of the components of the retractable lens system 20, the shutter assembly 40 includes a shutter frame 50 with a major wall 52 generally parallel to the film plane. A recess 54 in wall 52 receives a pair of shutter blades 56 operated in conventional fashion to admit light from the lens assembly 36 through an opening 57 in wall 52 for exposure of film at the backing plate 34. Mounting lugs 58 at the corners of wall 52 include apertures for fasteners (not shown) used to secure the shutter assembly in the fixed position within the camera body 24 as seen for example in FIGS. 1, 2 and 7-9.

Lens assembly 36 is mounted on the shutter frame 50 for linear movement along the optical axis A toward and away from the fixed film plane and shutter assembly 40. Assembly 36 includes a lens frame 59 having a mounting collar 60 in which is carried at least one optical lens element 62. The lens assembly 36 is mounted so that it is prevented from rotating and is held parallel with the film plane at all times. A first radially extending guide arm 64 has a recess slidingly engaging a post 66 extending from the wall 52. A second guide arm 68 includes an elongated position control shaft 70 slidably received in a guide sleeve 72 formed as

part of the shutter frame 50. Shaft 70 and sleeve 72 extend parallel with the optical axis A.

To vary the focus distance of the retractable lens system 20, the focus assembly 38 moves the lens assembly 36 in the direction of the optical axis A. A focus control solenoid 78 is secured in a solenoid housing 80 formed as part of the shutter frame 50 and includes an armature 82 that is moved in response to selective energization of the solenoid 78. A focus lever 84 includes a pivot mount end 86 mounted in a manner described below for pivotal movement of the lever 84.

The opposite end 88 of lever 84 includes a tab 90 captured in a groove 92 formed around the solenoid armature 82. Position control shaft 70 includes an extension 94 that is received beneath a projection 96 extending from the intermediate part of the focus lever 84. A spring 98 captured within the guide sleeve 72 constantly urges the shaft 70 and the rest of the lens assembly 36 outward with the projection 96 acting as an adjustable focus stop that determines the focus position of the lens element 62. The solenoid 78 is provided with a control signal in any suitable fashion to position the stop projection in a desired place in a range of focus positions extending from the close focus position of FIG. 8 to the far focus position of FIG. 9. In a fixed focus camera, while a stop may be adjusted to one selected operating position within a range of possible focus positions for calibration during manufacture, in use the lens assembly 36 has a single operating position instead of a range of operating positions.

Lens cover 42 is carried in a lens cover frame 102 attached to the front of the shutter frame 50. The cover 42 slides between the open and closed positions along a path that is generally parallel to the film plane and perpendicular to the optical axis A, but that is slightly curved in the illustrated arrangement to provide a compact arrangement corresponding to the generally curved shape of the camera 22. The upper part of cover 42 is captured and slidably guided by engagement with an upper guide tab 104 formed on the frame 102. An arm 106 extending from the

cover 42 is captured and guided between an additional pair of tabs 108 and 110. A button 112 on a depending foot portion 114 is used to open and close the cover 42, but other arrangements including motor drive arrangements could be used if desired.

When the lens cover 42 is moved to the closed position, the lens assembly is moved to a retracted position outside the range of focus positions and close to the shutter assembly 40. Position control shaft 70 includes a forward projection 118 projecting through an aligned opening in the lens cover frame 102. When the lens cover 42 is open (FIG. 3) the projection 118 extends into the path of the arm 106. When the cover 42 is closed, the arm initially engages the projection 118 (FIG. 2) and forces the lens frame 59 inwardly, toward the shutter assembly 40 and film plane, to the fully retracted position (FIG. 4).

As indicated above, the close and far focus positions are shown in FIGS. 8 and 9. FIG. 7 illustrates the retracted position of the lens assembly 36. As seen in that figure, the lens frame is retracted closer to the shutter assembly 40 than any of the possible focus positions. This movement to the retracted position can be accomplished regardless of the focus position selected at the time that the cover 42 is closed, and regardless of the position of the armature 82. The force applied by the spring 98 constantly urges the extension 94 against the stop projection 96. However, when the position control shaft 70 is retracted by closing the cover 42, the extension 94 can move away from the stop projection 96 as spring 98 compresses to permit this movement. The result is a very compact arrangement when the cover 42 is closed for storage or transport without the expense resulting from a moving shutter system.

A focus calibration system generally designated as 120 is incorporated into the retractable lens system 20. A

calibration wheel 122 having an eccentric hub 124 is mounted for rotation at the side of the shutter frame 50. A flexible detent arm 126 is formed integrally with the solenoid housing 80 and engages the spaced between detent teeth formed along the periphery of the wheel 122. The pivot mount end 86 of the focus lever 84 has an opening 128 that fits over the hub 124. Optical lens elements such as element 62 experience variations in characteristics such as back focal length that require calibration of the position of each specific lens. As seen in full and broken lines in FIG. 6, when the system 20 is assembled, the wheel 122 is rotated to a position that adjusts the pivot axis of the focus lever 84 and places the lens element 62 in the properly calibrated position. This position corresponds to the proper mechanical coupling between the armature 82 and lens assembly 36, and is maintained by the action of the detent arm 126. In a specific position of the wheel 122, the lens assembly 36 can be removed for repair or replacement without other disassembly of the retractable lens system 20.

While the invention has been described with reference to details of the embodiment of the invention illustrated in the drawings, these details are not intended to limit the scope of the invention as set forth in the appended claims.

CLAIMS

1. A camera comprising

a camera body;

means defining a film plane in said body;

a lens assembly including a lens;

a shutter assembly mounted in a fixed position transverse to the optical axis in said camera body between said film plane and said lens assembly;

mounting means supporting said lens assembly on said body for axial movement along the optical axis;

said camera being characterized by:

a stop supported by said camera body defining at least one operating position for said lens assembly, said operating position being within a range of possible focus positions of said lens assembly;

spring means continuously applying a force to said lens assembly urging said lens assembly axially away from said shutter assembly and against said stop; and

retraction means for moving said lens assembly away from said stop and against the force of said spring to a retracted postion adjacent said shutter assembly, said retracted position being outside said range of possible focus positions.

2. A camera as claimed in claim 1 further comprising a lens cover movable to open and closed positions.

3. A camera as claimed in claim 2, said retraction means including a portion of said lens cover coupled to said lens assembly for moving said lens assembly in response to movement of said lens cover to said closed position.

4. A camera as claimed in claim 3, said lens assembly comprising a door mounted on said body for sliding motion in a direction generally transverse to the optical

axis, and cam means coupled between said door and said lens assembly.

5. A camera as claimed in claim 1 further comprising drive means linked to said lens assembly for selectively moving said lens assembly in a range of focus positions at different axial distances from the film plane.

6. A camera as claimed in claim 5, said stop being adjustable in the direction of the optical axis, said drive means being operable to move said stop for determining a selected focus position.

7. A camera as claimed in claim 6, said drive means including a focus control solenoid having an armature engageable with said lens assembly, said adjustable stop being moved by said armature.

8. A camera as claimed in claim 7 further comprising a focus lever engageable with said armature and with said lens assembly for moving said lens assembly in response to movement of said armature.

9. A camera as claimed in claim 8, further comprising an adjustable pivot mounting for said focus lever, and detent means for holding said adjustable pivot mounting in a calibrated position for the back focal length of said lens assembly.

Patents Act 1977
Examiner's report to the Comptroller under section 17 (The Search Report)

Application number
9119468.8

Relevant Technical fields

(i) UK Cl (Edition K) HEADING G2A (MARKS ADA,ALAX)

(ii) Int Cl (Edition 5) IPC SUB-CLASS G03B

Search Examiner
R A SHORT

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search
13 DECEMBER 1991

Documents considered relevant following a search in respect of claims 1-9

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
A	GB 2058375 A ROLLEI-WERKE	-
A	GB 2042748 A AGFA-GEVAERT	-
A	GB 734177 A KODAK	-

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family, corresponding document.

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).

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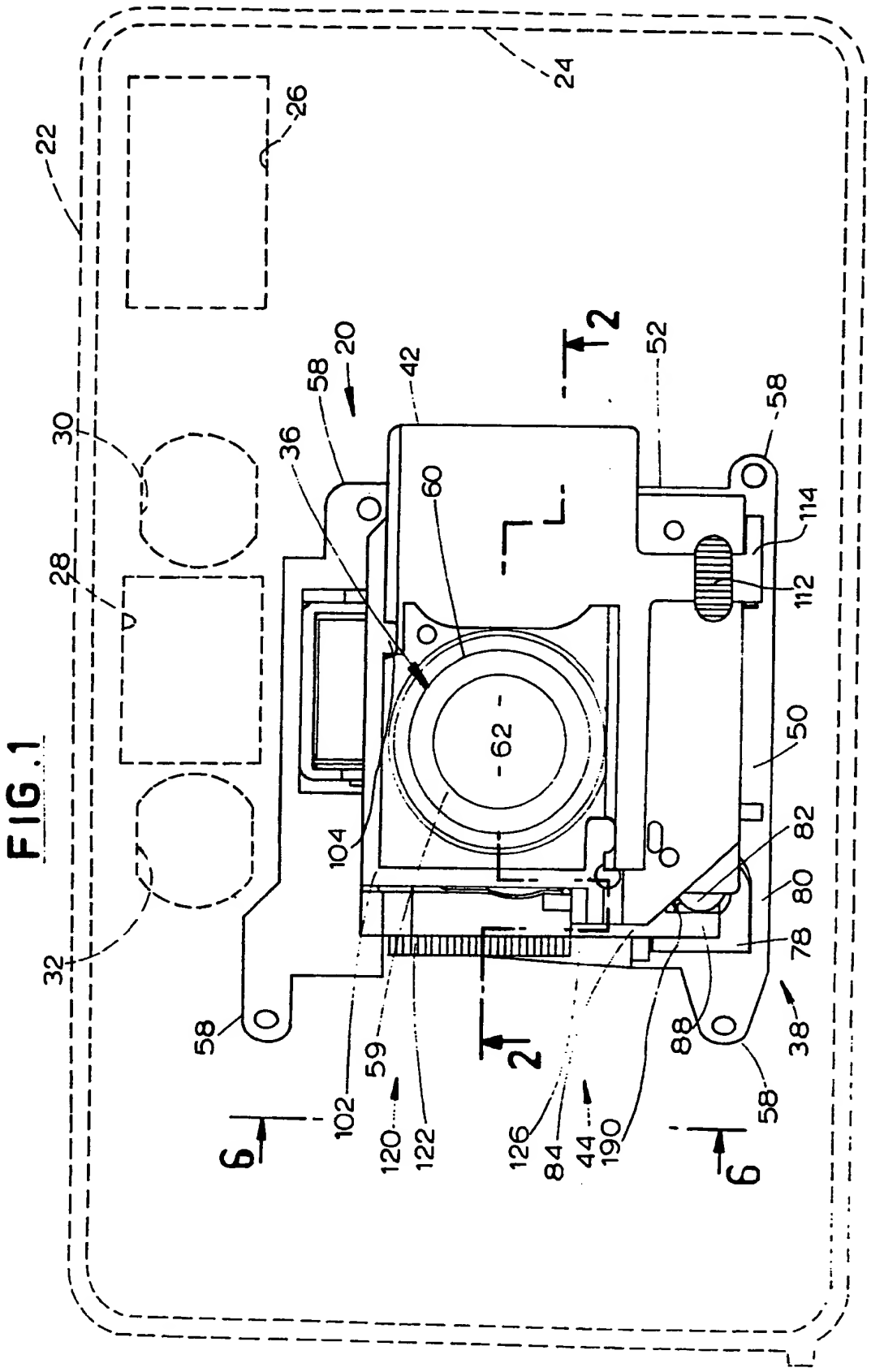
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FIG. 1

FIG. 2

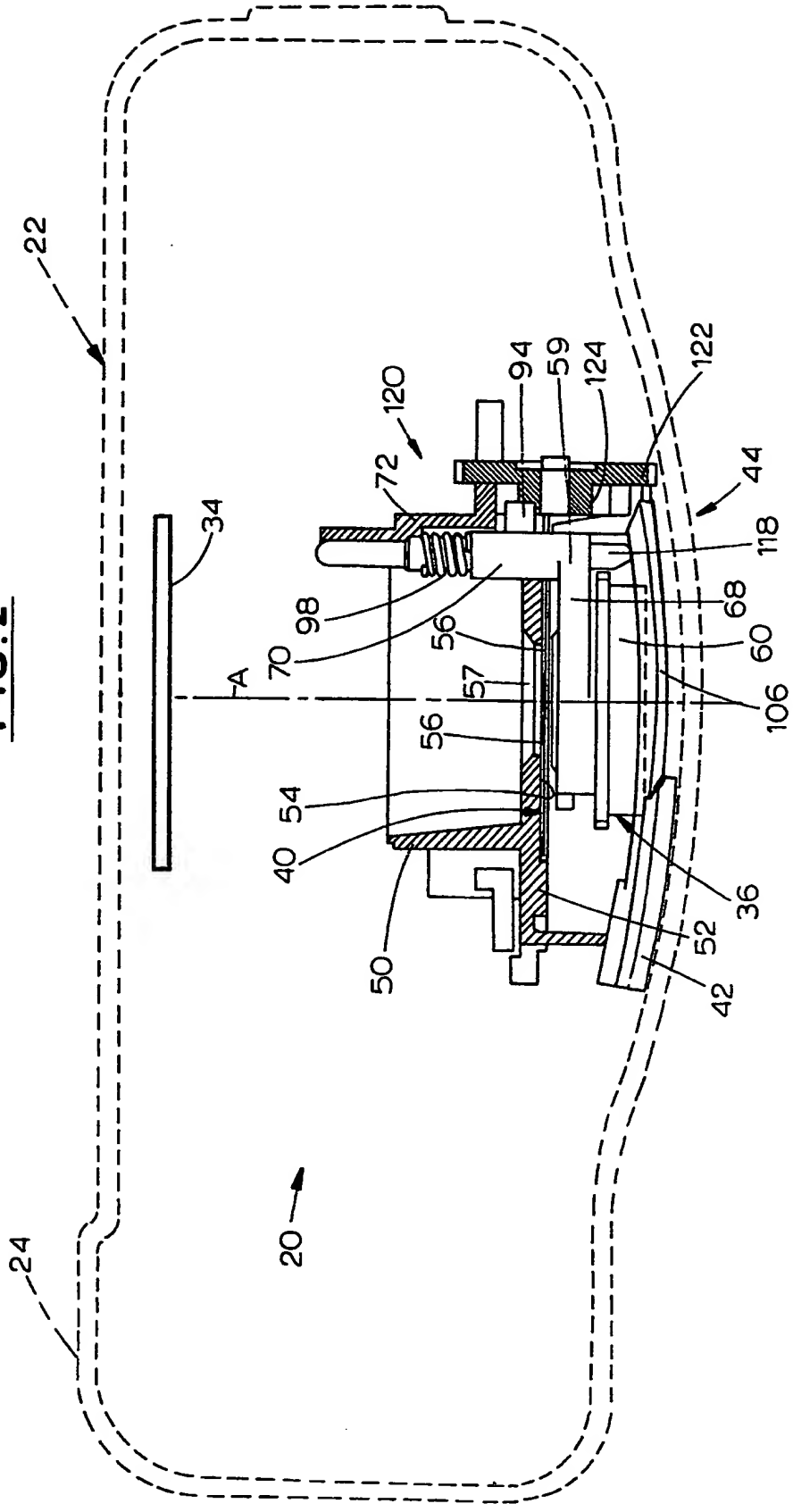
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FIG.3

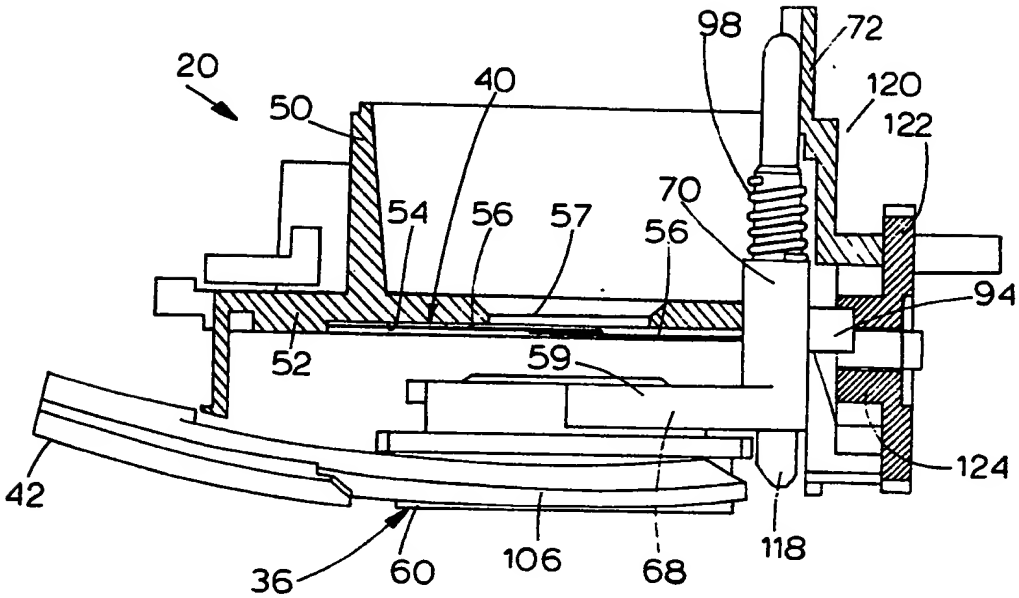
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FIG.4

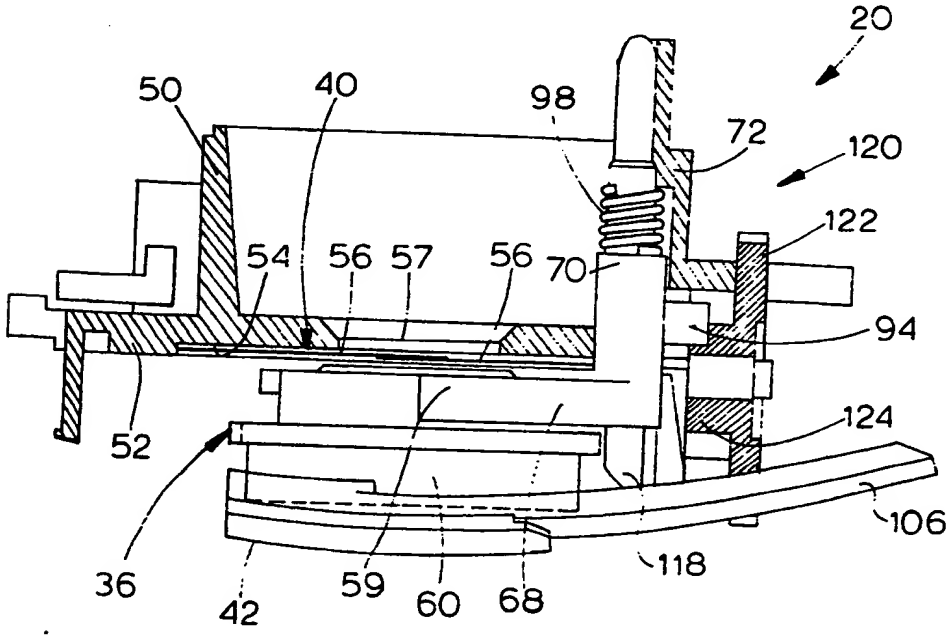
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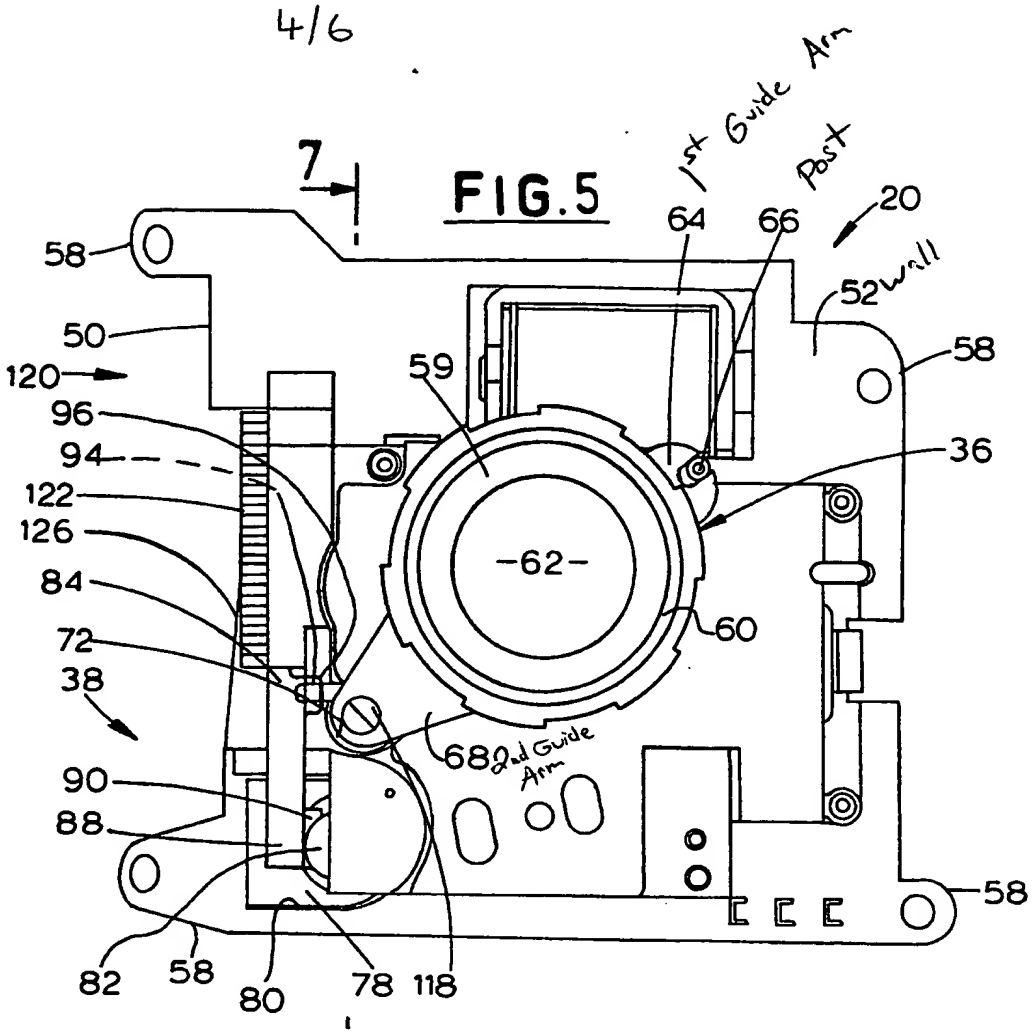
FIG.5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1st Guide Arm
Post
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66
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52 wall
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96
94
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36
-62-
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68 2nd Guide Arm
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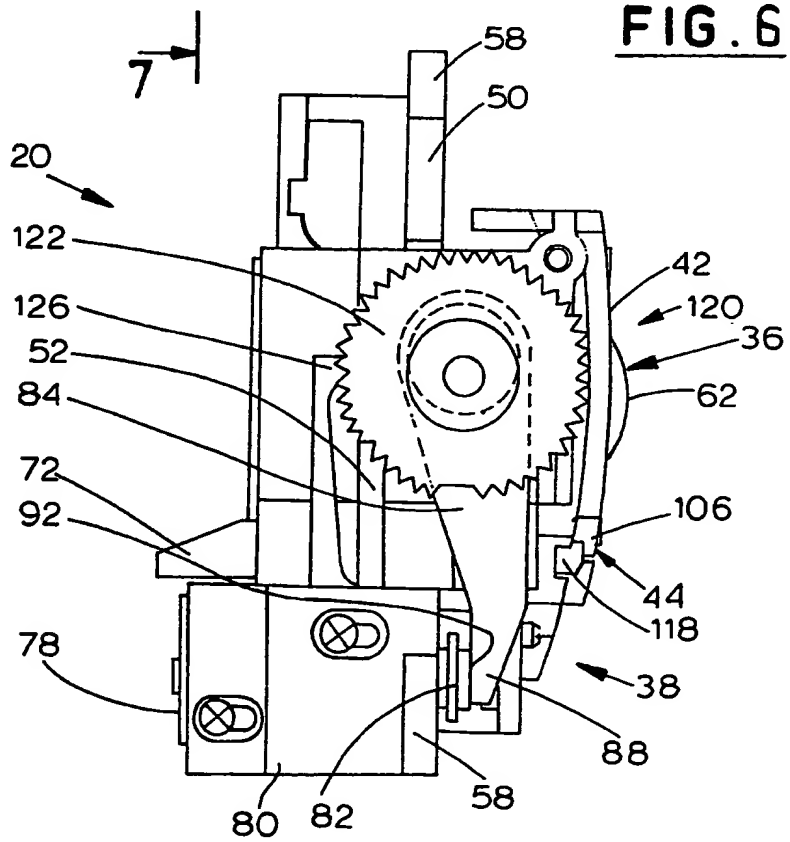
118

FIG.6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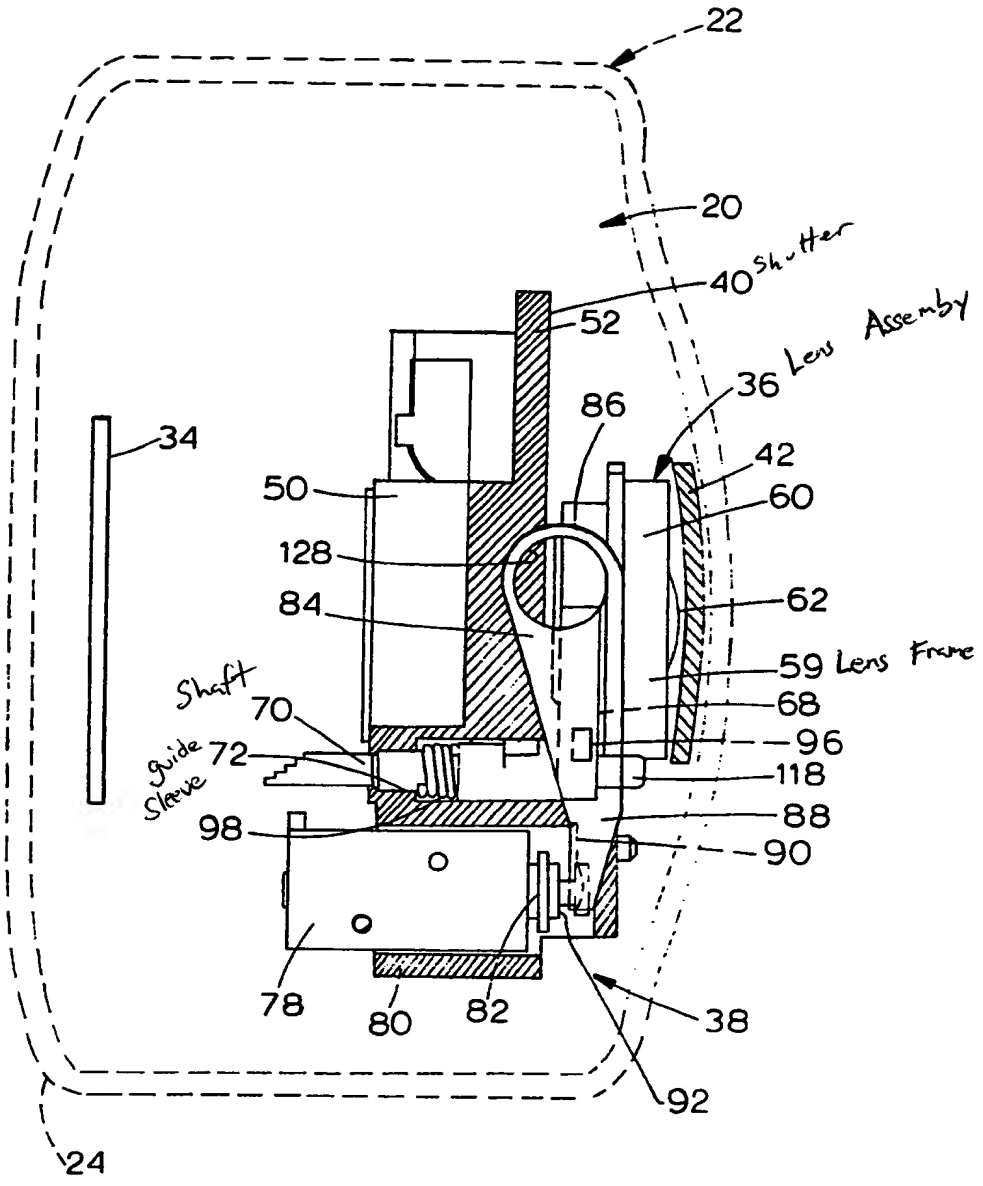
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36 Lens Assembly
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42
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128
62
84
59 Lens Frame
Shaft
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Guide Sleeve
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96
118
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24

FIG. 7

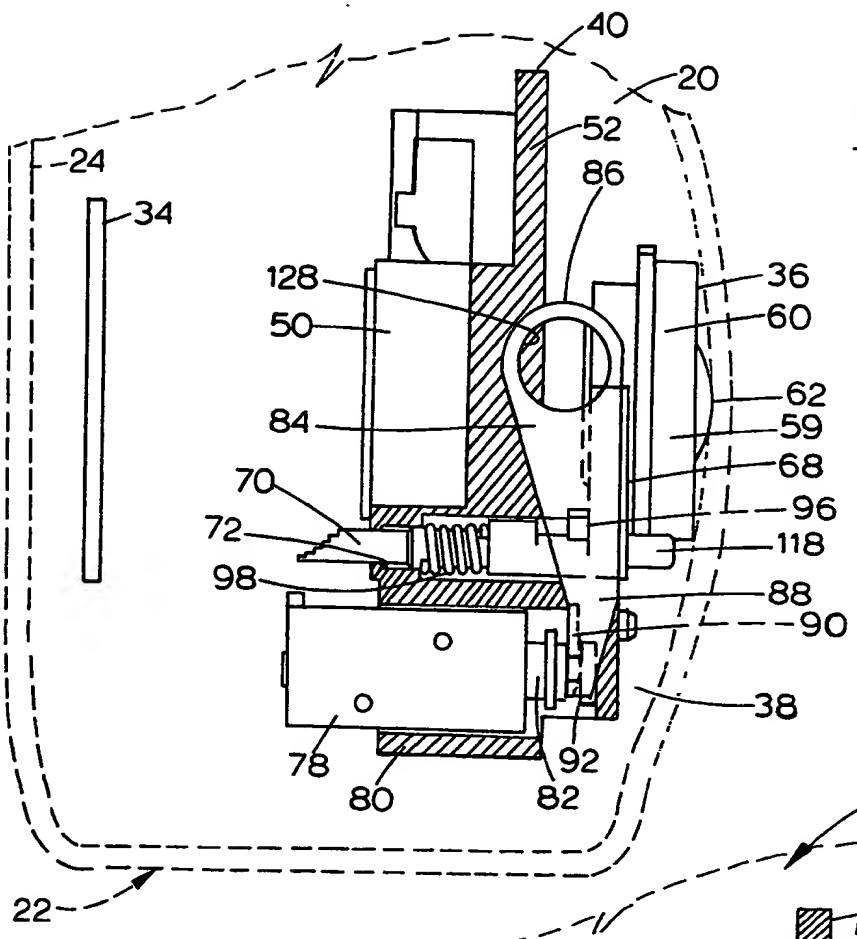
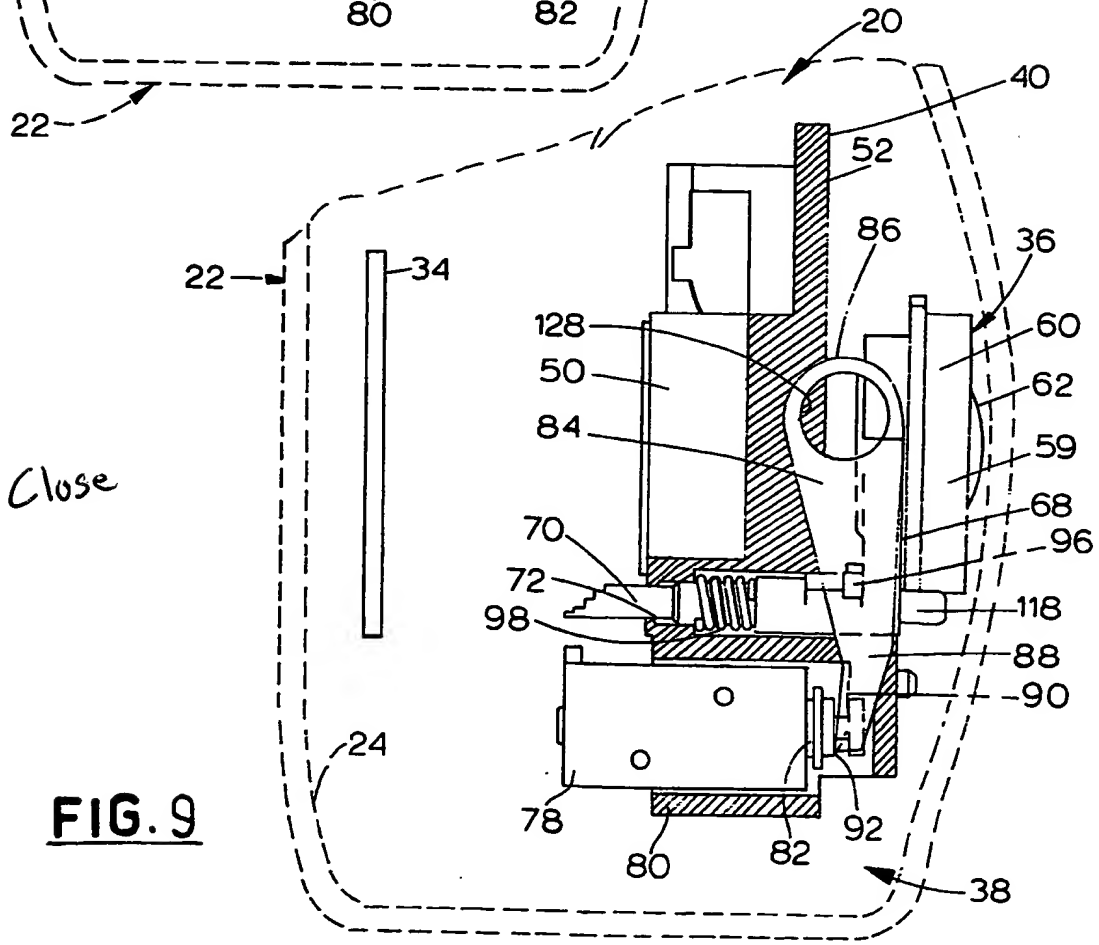


FIG. 8

Far



Close

FIG. 9